U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Stenogyne cranwelliae*

COMMON NAME: No common name

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
_X__ Continuing candidate
___ Non-petitioned
_X__ Petitioned - Date petition received: May 11, 2004
_ 90-day positive - FR date:
X 12-month warranted but precluded - FR date: May 11, 2005
N Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.
Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

_N_ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined):
September 19, 1997
___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Lamiaceae (Mint family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Hawaii

LAND OWNERSHIP: All *Stenogyne cranwelliae* populations occur on State (Forest Reserve and Natural Area Reserve) lands.

LEAD REGION CONTACT: Linda Belluomini, (503) 231- 6283, linda_belluomini @fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION

Species Description
Stenogyne cranwelliae is a creeping vine with sharply four-angled stems and pubescence concentrated on stem angles. The glabrous leaves are membranous, ovate, and have crenate margins. Flowers are arranged six per false whorl and are very pale pink with a nearly straight tube (Wagner *et al*. 1999, p. 837).

Taxonomy
Stenogyne cranwelliae was described by Sherff (1939). This species is recognized as a distinct taxon in Wagner et al. (1999, p. 837), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History
Stenogyne cranwelliae occurs only on the island of Hawaii within wet forest habitat dominated by *Metrosideros polymorpha* (ohia) (Perlman and Wood 1996; Weller and Sakai 1999).

Historical Range/Distribution
Historically, this species was found in the Kohala mountains on the island of Hawaii (HBMP 2008).

Current Range/Distribution
Currently, this species occurs in the Kohala mountains on the island of Hawaii (N. Agorastos, DOFAW, pers. comm. 2010).

Population Estimates/Status
The 10 remaining *Stenogyne cranwelliae* populations total fewer than 110 individuals. This species was thought to be extinct until rediscovered during surveys of the Kohala mountains in 1995 (Perlman and Wood 1996; Weller and Sakai 1999; N. Agorastos, pers. comm. 2010).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.
This species is highly and imminently threatened by feral pigs (*Sus scrofa*) whose activities degrade and destroy habitat within its remaining range on the island of Hawaii (Hawaii Biodiversity and Mapping Program (HBMP) 2006; 2008). Evidence of the activities of feral pigs has been recorded at all 10 populations of *S. cranwelliae* (HBMP 2008). No conservation measures have been taken to address this threat to date (Perlman and Wood 1996; HBMP 2008).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, formed herds, and are now managed as a game animal by the State (Tomich 1986; State of Hawaii 2001). In a study conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui, the deleterious effects of feral pig rooting on native forest ecosystems was documented (Diong 1982). Kipahulu Valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* (koa) and *Metrosideros polymorpha* (ohia). Rooting by pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 inches (20 centimeters), greatly disrupting the leaf litter and topsoil layers, and contributing to erosion and changes in ground topography. The feeding habits of pigs were observed to create seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs and other introduced ungulates (Loope *et al*. 1991). Because of demonstrated habitat modifications by pigs, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants, the Service believes feral pigs are a threat to *Stenogyne cranwelliae*.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Disease is not known to be a threat to this species. However, predation by rats is a likely threat to *Stenogyne cranwelliae* (HBMP 2008). The threat from rat predation has been reported at 5 of

the 10 known populations (HBMP 2008). Of the four species of rodents that have been introduced to the Hawaiian Islands, the species with the greatest impact on the native flora and fauna is probably the black or roof rat (*Rattus rattus*), which now occurs on all the main Hawaiian Islands. Black rats, and to a lesser extent the house mouse (*Mus musculus*), the Polynesian rat (*R. exulans*), and the Norway rat (*R. norvegicus*), eat the fruits of some native plants, while black rats are reported to strip the bark from some native plants (Tomich 1986; Cuddihy and Stone 1990).

Predation by feral pigs is a likely threat to *Stenogyne cranwelliae* because evidence of pig activities in all known locations of this species has been reported (Perlman and Wood 1996; HBMP 2008). Browsing by ungulates has been observed on many native plant species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al*. 1991). Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980). Pigs are omnivorous in their diet. In the study described above on feral pig populations in the Kipahulu Valley, pigs were observed browsing on young shoots, leaves and fronds of a wide variety of plants, of which over 85 percent were endemic species (Diong 1982). A stomach content analysis showed that the pigs' food sources consisted of native plants, 60 percent of which were *Cibotium* spp. (tree ferns), alternating with *Psidium cattleianum* when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species (herbaceous and woody plants), with larger trees killed over a few months of repeated feeding. Therefore, even though we have no evidence of direct browsing for *S. cranwelliae*, it is likely that feral pigs impact this species.

D. The inadequacy of existing regulatory mechanisms.
Stenogyne cranwelliae currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pigs are managed in Hawaii as game animals but many populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting is not adequate to eliminate this threat to *Stenogyne cranwelliae*.

E. Other natural or manmade factors affecting its continued existence.
Stenogyne cranwelliae is threatened by several nonnative plant species that degrade and destroy habitat and outcompete native plants (HBMP 2008). With only 10 populations totaling fewer than 110 individuals, reduced reproductive vigor and extinction due to stochastic events, such as hurricanes and landslides, are also potential threats to this species (K. Wood, National Tropical Botanical Garden (NTBG), pers. comm. 1995; Perlman and Wood 1996). The nonnative plants that are reported to be the greatest threats to *S. cranwelliae* are *Hedychium* spp. (white and kahili ginger), *Juncus* spp. (Japanese mat rush and dagger-leaved rush), and *Tibouchina herbacea* (glorybush) (HBMP 2008).

Hedychium coronarium was introduced to Hawaii in the late 1800s, probably by Chinese immigrants. It escaped from cultivation and is found in wet and mesic forests on most of the

main Hawaiian Islands. The large, vigorous herbs mainly reproduce vegetatively, forming very dense stands that exclude all other growth (Wagner *et al.* 1999).

Hedychium gardnerianum was introduced to Hawaii before 1940 from the Himalayas and occurs on the islands of Maui, Kauai, and Hawaii. This species is considered a more serious threat to native forests because it produces abundant fruit and fleshy, red seeds that are dispersed by fruit-eating birds as well as man. It forms vast, dense colonies, displacing other plant species, and reproduces by rhizomes. Aircraft-based analysis has shown that ginger reduces the amount of nitrogen in the *Metrosideros* forest canopy in Hawaii, a finding subsequently corroborated by ground-based sampling (Asner and Vitousek 2005). It may also block stream edges, altering water flow (Global Invasive Species Database 2005). Kahili ginger can be controlled by herbicides, but biological control is considered the only practical approach for the long-term management of large infestations in native forests. The two *Hedychium* species have invaded at least one of the *Stenogyne cranwelliae* populations (HBMP 2008) and no known conservation measures have been taken to date to address this particular threat.

Juncus spp. are perennial herbs which have naturalized in moist, open, disturbed areas in bogs and forest margins in Hawaii. These plants form dense mats and displace native species by preventing establishment of seedlings (Medeiros *et al*. 1991; Coffey 1999; Pojar and Mackinnon 1994). *Juncus effusus* is a perennial herb widely distributed in temperate regions and naturalized in Hawaii in ponds, streams, and open boggy sites. This plant spreads by seeds and rhizomes, and forms dense mats that crowd out native plants (Coffey 1999). *Juncus ensifolius*, a perennial herb native to the western United States, is naturalized in standing water of marshy areas in Hawaii (Coffey 1999). This weedy colonizer can tolerate environmental stress and out-compete native species (Pojar and Mackinnon 1994). The two *Juncus* species have invaded at least 5 of the10 *Stenogyne cranwelliae* populations (HBMP 2008) and no known conservation measures have been taken to date to address this particular threat.

Tibouchina herbacea first became established on the island of Hawaii in the late 1970s (Almeda 1999). Although the disruptive potential of this alien plant is not fully known, *T. herbacea* appears to be invading mesic and wet forests of Hawaii and Maui (Cuddihy and Stone 1990). This species has invaded at least 5 of the 10 *Stenogyne cranwelliae* populations (HBMP 2008).

The original native flora of Hawaii consists of about 1,400 species, nearly 90 percent of which are endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999). Confirmed personal observations (HBMP 2008) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *Stenogyne cranwelliae*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or

altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1997). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the wet *Metrosideros polymorpha-Dicranopteris linearis* montane mesic forest habitat of *S. cranwelliae* the Service believes nonnative plant species are a threat to this species.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Stenogyne cranwelliae is in cultivation at Volcano Rare Plant Facility (VRPF), and 89 individuals have been outplanted at Kohala (P. Moriyasu, VRPF, pers. comm. 2009; N. Agorastos, pers. comm. 2010)

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs and nonnative plants, we conclude there is sufficient information to develop a proposed rule for *Stenogyne cranwelliae* due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of the species due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs and rats is likely a threat to the species and habitat degradation or destruction, or direct destruction of plants by randomly occurring natural events such as hurricanes and landslides are potential threats. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Protect all individuals from feral pigs
- Control nonnative plant species
- Control rats
- Develop and implement methods to control nonnative plant species such as *Hedychium* spp, *Juncus* spp., and *Tibouchina herbacea*
- Conduct/update field surveys at known locations and in suitable habitat
- Propagate and maintain genetic stock

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate	Imminent	Monotypic genus	7
		Species	8

to Low	Non-imminent	Subspecies/population Monotypic genus Species Subspecies/population	9 10 11 12

Rationale for listing priority number:

Magnitude:
This species is highly threatened by feral pigs that degrade and destroy habitat and nonnative plants that degrade habitat and compete with native plants for light and nutrients. Predation by feral ungulates and rats is a likely threat. Threats to the wet forest habitat of *Stenogyne cranwelliae,* and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication. Individuals are in propagation at Volcano Rare Plant Facility for outplanting.

Immediacy of threats:
Threats to *Stenogyne cranwelliae* from feral pigs and nonnative plants are considered imminent because they are ongoing. Because predation by feral ungulates and rats is a likely threat, it may also be considered imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of the species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING
Much of the information on this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Joel Lau, Hawaii Biodiversity and Mapping Program, and Ken Wood of the National Tropical Botanical Garden in 1999. We incorporated additional information on this species from our files and the most recent supplement to the *Manual of Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Biodiversity and Mapping Program; Arthur Medeiros, U.S.G.S. Biological Resource Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information was provided. In 2005 we contacted species experts and confirmation of the status was provided by Kapua Kawelo, Army Environmental. In 2006 no new information was

provided. In 2008 we received confirmation of the status of *Stenogyne cranwelliae* from Kealii Bio, Plant Extinction Prevention Program. In 2009 we received new information from Patrice Moriyasu, Volcano Rare Plant Facility. In 2010, we contacted the species experts listed below, and received new information from Nick Agorastos, DOFAW.

List all experts contacted:

Name	Date	Affiliation
Agorastos, Nick	02/09/10	Division of Forestry and Wildlife
Anderson, Stephen	02/09/10	National Park Service, Haleakala NP, Maui
Aruch, Sam	02/09/10	private contractor
Bakutis, Ane	02/09/10	Plant Extinction Prevention Program, Molokai
Ball, Donna	02/09/10	U.S. FWS, Partners Program, Hawaii Island
Beavers, Sally	02/09/10	National Park Service, Hawaii Island
Bily, Pat	02/09/10	The Nature Conservancy, Maui
Bio, Kealii	02/09/10	Plant Extinction Prevention Program, Hawaii Island
Brosius, Chris	02/09/10	West Maui Mountains Watershed Partnership
Caraway, Vickie	02/09/10	Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan	02/09/10	Plant Extinction Prevention Program, Oahu
Cole, Colleen	02/09/10	Three Mountain Alliance
Conry, Paul	02/09/10	Hawaii Department of Land and Natural Resources
Coordinator	02/09/10	East Maui Watershed Partnership
Duvall, Fern	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri	02/09/10	The Nature Conservancy, Maui
Garnett, Bill	02/09/10	National Park Service, Kalaupapa, Molokai
Giffin, Jon	02/09/10	The Nature Conservancy, Hawaii Island
Haus, Bill	02/09/10	National Park Service, Haleakala NP, Maui
Higashino, Jennifer	02/09/10	U.S. FWS, Maui
Imada, Clyde	02/09/10	Bishop Museum
Jacobi, Jim	02/09/10	U.S.G.S., Biological Resources Division
Kawakami, Galen	02/09/10	Division of Forestry and Wildlife, Kauai
Kawelo, Kapua	02/09/10	U.S. Army, Environmental Division
Kier, Matt	02/09/10	U.S. Army, Environmental Division
Kiyabu, Brian	02/09/10	Amy Greenwell Botanical Garden
Kraus, Jim	02/09/10	U.S. FWS, Hakalau NWR
Medeiros, Arthur	02/09/10	U.S. Geological Survey
Misaki, Ed	02/09/10	The Nature Conservancy, Molokai
Moriyasu, Patty	02/09/10	Volcano Rare Plant Facility, Hawaii Island
Moses, Wailana	02/09/10	The Nature Conservancy, Molokai
Nakai, Glynnis	02/09/10	U.S. FWS, Refuges, Maui
Oppenheimer, Hank	02/09/10	Plant Extinction Prevention Program, Maui Nui
Palomino, Anna	02/09/10	Olinda Rare Plant Nursery, Maui
Palumbo, David	02/09/10	National Park Service, Haleakala NP, Maui
Pepi, Vanessa	02/09/10	U.S. Navy, Environmental Contractor
Perlman, Steve	02/09/10	National Tropical Botanical Garden
Perry, Lyman	02/09/10	Division of Forestry and Wildlife, Hawaii Island

Plunkett, Bryan	02/09/10	Lanai Forest and Watershed Partnership
Pratt, Linda	02/09/10	U.S.G.S., Biological Resources Division
Purell, Melora	02/09/10	Kohala Watershed Partnership
Seidman, Stephanie	02/09/10	Maui Nui Botanical Garden
Shishido, Glenn	02/09/10	Division of Forestry and Wildlife, Maui
Silbernagle, Mike	02/09/10	U.S. FWS, Refuges, Oahu
Smith, Miranda	02/09/10	Koolau Mountains Watershed Partnership
Starr, Forest	02/09/10	U.S. Geological Survey
Tanaka, Daniel	02/09/10	Puu Kukui Watershed Preserve
Ward, Joe	02/09/10	Puu Kukui Watershed Preserve
Welton, Patti	02/09/10	National Park Service, Haleakala NP, Maui
Wood, Ken	02/09/10	National Tropical Botanical Garden
Wysong, Michael	02/09/10	DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (facing a very high risk of extinction in the wild) (IUCN 2006). The species is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al*. 2005).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. No additional information or comments were received.

LITERATURE CITED

Almeda, F. 1999. Melastomataceae. *In* Manual of the Flowering plants of Hawaii, Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), University of Hawaii Press and Bishop Museum Press, Honolulu, Bishop Museum Special Publication 97. Pp. 903-917.

Anderson, R.C. 2003. Kahili-make: a biological control project against kahili ginger. Presentation for U.S.G.S. Biological Resources Division, Pacific Island Ecosystems Research Center, Honolulu.

Anderson, R.C. and D.E. Gardner. 1999. An evaluation of the wilt-causing bacterium *Ralstonia solanacearum* as a potential biological control agent for the alien kahili ginger (*Hedychium gardnerianum*) in Hawaiian forests. Biological Control 15: 89-96.

Anderson, S.J., C.P. Stone, and P.K. Higashino. 1992. Distribution and spread of alien plants in Kipahulu Valley, Haleakala National Park, above 2,300 ft elevation. *In* Alien Plant Invasions in Native Ecosystems of Hawaii: Management and research, C.P. Stone, C.W. Smith, and J.T. Tunison (eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 300-338.

Asner, G. and P. Vitousek. 2005. Scientists use aerial imaging to find hidden invaders in

Hawaiian rain forest. Stanford Report, Stanford University, March 9, 2005. 2 pp. http://news-service.stanford.edu/news/2005/march9/invade-030905.html, accessed on February 21, 2007.

Bruegmann, M.M. and V. Caraway. 2003. *Melicope makahae*. *In* IUCN 2006 Red List of Threatened Species, http://www.iucn.redlist.org, accessed on December 18, 2006.

Carlquist, S. 1980. Hawaii: a natural history, second edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

Coffey, J.C. 1999. Juncaceae. *In* Manual of the Flowing Plants of Hawaii, Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publication 97. Pp. 1,451-1,455.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. 138 pp.

Diong, C.H. 1982. Population biology and management of the feral pig (*Sus scrofa* L.) in Kipahulu Valley, Maui. Dissertation to the Zoology graduate division of the University of Hawaii. 408 pp.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 95. Pp. 22-24.

Global Invasive Species Database. 2005. *Hedychium gardnerianum* (herb). http://www.issg.org/database/species/ecology.asp?si=57&fr=1&sts, accessed on February 20, 2007.

Hawaii Biodiversity and Mapping Program. 2008. Hawaii Biodiversity and Mapping Program species database. Unpublished.

Hawaii Biodiversity and Mapping Program. 2006. *Stenogyne cranwelliae*. http://www.hbmp.hawaii.edu/printpage.asp?spp=PDLAM1Y080, accessed on February 27, 2007.

Hawaii, Department of Land and Natural Resources. 1999. Rules regulating game mammal hunting, updated 2003. 56 pp.

Hawaii Heritage Program. 1990. Management recommendations for Na Pali coast state park, island of Kauai. The Nature Conservancy, prepared for the Hawaii Department of Land and Natural Resources, Division of State Parks, Honolulu. 18 pp.

Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the

Hawaiian Botanical Society 31: 7-8.

Loope, L.L., A.C. Medeiros, and B.H. Gagné. 1991. Recovery of vegetation of a montane bog following protection from feral pig rooting. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 77. 23 pp.

Loope, L., F. Starr, and K. Starr. 2004. Protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.

Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.

Medeiros, A.C., L.L. Loope, and B.H. Gagné. 1991. Degradation of vegetation in two montane bogs of Haleakala National Park: 1982-1988. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 78. 23 pp.

Medeiros, A.C., Jr., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, east Maui, Hawaii. Cooperative Natlional Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 59. 230 pp.

Medeiros, A.C., L.L. Loope, P. Conant, S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Museum Occasional Papers 48: 23-36.

Meyer, J.-Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvescens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. Hawaii's comprehensive wildlife conservation strategy. Department of Land and Natural Resources, Honolulu, Hawaii. 722 pp.

Nagata, K. 1999. Zingiberaceae, ginger family. *In* Manual of the Flowering Plants of Hawaii, Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publication 97. Pp. 1,616-1,624.

O'Connor, P.J. 1990. Poaceae, grass family. *In* Manual of the Flowering plants of Hawaii, Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), University of Hawaii Press and Bishop Museum Press, Honolulu, Bishop Museum Special Publication 97. Pp. 1,481-1,604.

Perlman, S. and K. Wood. 1996. Kohala Mountains surveys. Prepared by National Tropical Botanical Garden for U.S. Fish and Wildlife Service, Honolulu.

Pojar, J. and A. MacKinnon (eds.). 1994. Plants of the Pacific Northwest coast. Vancouver, BC:

Lone Pine Publishing. 528 pp.

Robichaux, R.J. Canfield, F. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. Adaptive radiation. Endangered Species Bulletin. November/December. Pp. 3-5.

Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9:1-429.

Sherff, E.E. 1939. Some new or otherwise noteworthy Labiatae and Compositae. Field Museum Natural History, Botanical Services 17: 577-612.

Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawaii. Proceedings of the Second Conference on Natural Science, Hawaii Volcanoes National Park. Pp. 274-288.

Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota. *In* Hawaii's Terrestrial Ecosystems: Preservation and Management, C.P. Stone and J.M. Scott (eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 180-250.

State of Hawaii. 2001. Game mammal hunting guide. http://www.state.hi.us/dlnr/dcre/mammalguide.html, accessed on February 13, 2007.

Stone, C.P. 1985. Alien animals in Hawaii's native ecosystems: toward controlling the adverse effects of introduced vertebrates. *In* Hawaii's Terrestrial Ecosystems: Preservation and Management, Stone, C.P., and J.M. Scott (eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 251-297.

Tomich, P.Q. 1986. Mammals in Hawaii; a synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.

U.S. Fish and Wildlife Service. 2005. Controlled propagation database. Unpublished.

Vitousek, P.M., C. M. D'Antonio, L.L. Loope, M. Rejmanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21: 1-16.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the flowering plants of Hawaii. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publications 97. 1,918 pp.

Wagner, W.L., M.M. Bruegmann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Museum Occasional Papers. 60: 1-58.

Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants

of Hawaii, Version 3.1. December 12, 2003. http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm.

Weller, S.G. and A.K. Sakai. 1999. *Stenogyne*. *In* Manual of the Flowering Plants of Hawaii, Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), University of Hawaii Press and Bishop Museum Press; Honolulu. Bishop Museum Special Publication 97. Pp. 831-843.

Wester, L. 1992. Origin and distribution of adventive alien flowering plants in Hawaii. *In* Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research, C.P. Stone, C.W. Smith, and J.T. Tunison (eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 99-154

Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. National Tropical Botanical Garden. 25 pp.

Personal Communications and in litt

Agorastos, N., Division of Forest and Wildlife, Electronic mail message regarding the status of plant candidate species on the island of Hawaii, February 09, 2010.

Bio, K., Plant Extinction Prevention Program, Electronic mail message regarding the status of *Stenogyne cranwelliae*, March 3, 2008.

Kawelo, K., U.S. Army Environmental, Response to FY 2005 Candidate Status Information table, June 28, 2005.

Lau, J., Hawaii Natural Heritage Program, Response to FY 1999 Candidate Status Information table, September 29, 1999.

Moriyasu, P., Volcano Rare Plant Facility, Electronic mail response to request for candidate species information, February 25, 2009.

Wood, K., National Tropical Botanical Garden, Response to FY 1999 Candidate Status Information table, September 29, 1999.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Carolyn A. Bohan
Regional Director, Region 1, Fish and Wildlife Service

5/18/10
Date

Rowan W Gould
ACTING
Director, Fish and Wildlife Service

October 22, 2010

Concur:

Do not concur: _____ Date: _____

Director's Remarks:

Date of annual review: Date: April 26, 2010
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 26, 2010
Prelisting and Listing Program Coordinator

Marilet Zablan Date: April 26, 2010
Assistant Field Supervisor, Endangered Species Division

Gina Shultz Date: April 30, 2010
Acting Field Supervisor